

**INTERNATIONAL PRELIMINARY EXAMINATION REPORT**  
**(PCT Article 36 and Rule 70)**

Applicant's or agent's file reference P 02058 WO	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/EP 03/13044	International filing date (day/month/year) 17.11.2003	Priority date (day/month/year) 18.11.2002
International Patent Classification (IPC) or both national classification and IPC F16L11/15		
Applicant NORSK HYDRO ASA et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
  
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
  - This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 2 sheets.
  
3. This report contains indications relating to the following items:
  - I  Basis of the opinion
  - II  Priority
  - III  Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
  - IV  Lack of unity of invention
  - V  Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
  - VI  Certain documents cited
  - VII  Certain defects in the international application
  - VIII  Certain observations on the international application

Date of submission of the demand  07.12.2004	Date of completion of this report  11.03.2005
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer  Dauvergne, B Telephone No. +49 89 2399-7527



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/EP 03/13044

**I. Basis of the report**

1. With regard to the elements of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, Pages**

1-14 as originally filed

**Claims, Numbers**

1-12 received on 14.12.2004 with letter of 07.12.2004

**Drawings, Sheets**

1/2-2/2 as originally filed

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- the language of publication of the international application (under Rule 48.3(b)).
- the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- contained in the international application in written form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- the description, pages:
- the claims, Nos.:
- the drawings, sheets:

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5.  This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).  
*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*
6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes: Claims	
	No: Claims	1-12
Inventive step (IS)	Yes: Claims	
	No: Claims	1-12
Industrial applicability (IA)	Yes: Claims	1-12
	No: Claims	

**2. Citations and explanations**

**see separate sheet**

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**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

Reference is made to the following document:

D1: US-A-6 006 788 (JUNG PATRICE JOEL LOUIS ET AL) 28 December 1999 (1999-12-28)

**1- Novelty:**

**1-1 Claim 1:**

From D1, a flexible, tubular metal device (1, Fig.4) is known comprising one or more corrugated convolutions.

The convolutions have an overall bell like shape with rounded top portions (11) and rounded bottom portions (13) where the curvature of the outside surface of the convolutions is numerically smaller at the top portions (11) than at the bottom portions (13).

The curvature of said curve changes sign only once at a change position located between a top portion and an adjacent bottom portion, and the length of a first section on the curve is at least 10% longer than the length of a second section on the curve, said first section extending from one change position to an adjacent change position via a top portion, and said second section extending from one change position to an adjacent change position via a bottom portion.

Said convolutions are placed perpendicular to a longitudinal axis (See Fig.4) of the device and that said curve is continuous and is, as any continuous curve -even a constant curve-, at least two times differentiable\*.

\*The differential of  $f(x)=a$  where  $a$  is a constant is 0, and the differential of  $f(x)=0$  is 0.

**1-2 Claims 2, 8:**

See Fig.4.

**1-3 Claim 3:**

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From Fig.4, it is obvious that  $1/R$  top  $< 0.8$   $1/R$  bottom.

**1-4 Claim 4:**

From D1 claim 1,  $0.5 < 2w/q < 14.3$ .

**1-5 Claims 5, 7:**

See Fig.4 and 2-1.

**1-6 Claim 6:**

See 2-1.

**1-7 Claims 9, 10:**

The processes and metals mentioned are known a widespread in the art of forming thin metallic articles.

**1-8 Claims 11, 12:**

There are no limiting features in these claims which thus can be read as 'use of device according to claim 1'.

**2- Certain observations on the international application**

**2-1 Claim 5:**

It is not clear what a 'global' 'optimum' is or a 'global' minima is. Furthermore a 'local' minimum can be interpreted as the minimum value at one single point, which is the value of this point, thus the minimum and the maximum.

Claims

- 1: A flexible, tubular metal device e.g. a bellows with an internal diameter up to 60 millimeters, said device comprising one or more corrugated convolutions(2),  
5 said convolutions having an overall bell-like shape with rounded top portions(T) and rounded bottom portions(B,B') where the curvature of the outside surface of the convolutions(2) is numerically smaller at the top portions(T) than at the bottom portions(B,B'), said curvature being derived from a curve(6) defined as the intersection of the outside surface(4) of the device and a plane through the  
10 longitudinal axis(8) of the device, and where the curvature of said curve changes sign only once at a change position(P,P') located between a top portion(T) and an adjacent bottom portion (B,B''), and where the length of a first section(7) on the curve(6) is at least 10% longer than the length of a second section(9) on the curve, said first section(7) extending from one change position(P) to an adjacent change position(P') via a top portion(T), and said  
15 second section(9) extending from one change position(P) to an adjacent change position(P') via a bottom portion(B,B''), characterised in that said convolutions are placed perpendicular to a longitudinal axis (8) of the device and that said curve(6) is continuous and at least two times differentiable.
- 20 2. A device according to claim 1, characterised in that the length of a first section(7) on the curve(6) is at least 50% longer than the length of a second section(9) on the curve, said first section(7) extending from one change position(P) to an adjacent change position(P') via a top portion(T), and said  
25 second section(9) extending from one change position(P) to an adjacent change position(P') via a bottom portion(B,B'').
- 30 3. A device according to claim 1 or 2, characterised in that the curvature of the convolutions is numerically at least 20% smaller by the top portions(T) than by the bottom portions(B,B').
4. A device according to one or more of claims 1-3, characterised in that the pitch-height ratio(q) is between 0.7 and 1.0.

5. A device according to one or more of claims 1-4, characterised in that the curve(6) between a bottom(B,B') and an adjacent bottom section(B',B) has one global optimum placed at the top portion(T) and two global minima, said minima being placed by the bottom portions(B,B'), and in that the curvature by the global maximum of the curve(6) has a local minimum.
10. 6. A device according to one or more of claims 1-5, characterised in that the curvature of the curve(6) between a top portion(T) and an adjacent bottom section(B',B) has a local minimum.
15. 7. A device according to one or more of claims 1-6, characterised in that a section of the curve(6) corresponding to one convolution from one bottom portion(B) to an adjacent bottom portion(B') is symmetric about an axis perpendicular to the longitudinal axis(8) and through the global optimum within the top portion(T).
20. 8. A device according to one or more claims 1-7, characterised in that the majority of the convolutions are substantially identical.
25. 9. A device according to one or more of claims 1-8, characterised in that the device is made of an extruded metal alloy pipe and in that the convolutions are formed in a deep drawing process such as elastomeric forming or hydro forming.
10. 10. A device according to claim 9, characterised in that the metal alloy is stainless steel or an aluminium alloy.
11. Use of a device according to one or more of the preceding claims for flexible coupling of pipes or tubes in a vehicle, e.g. a car.
30. 12. Use according to claim 11 for the coupling of pipes or tubes in the air-condition system in a car.